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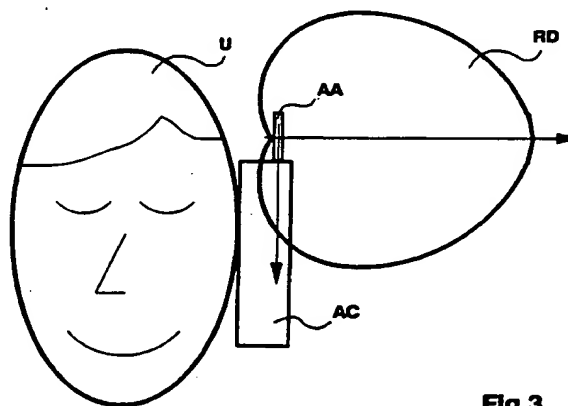
**EUROPEAN PATENT APPLICATION**(21) Application number: **93114643.5**(51) Int. Cl.<sup>5</sup>: **H04B 1/38, H01Q 1/24**(22) Date of filing: **11.09.93**(30) Priority: **18.09.92 IT MI922146**(43) Date of publication of application:  
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SE**(71) Applicant: **ALCATEL ITALIA S.p.A.**  
**Via L. Bodio, 33/39**  
**I-20158 Milano(IT)**(72) Inventor: **Maggio, Claudio**  
**Via Garigilano, 8**  
**I-00040 Ardea, Roma(IT)**  
Inventor: **Panico, Luigi**  
**Via Primo Baratta, 21**  
**I-84091 Battipaglia/SA(IT)**(74) Representative: **Pohl, Herbert, Dipl.-Ing et al**  
**Alcatel SEL AG**  
**Patent- und Lizenzwesen**  
**Postfach 30 09 29**  
**D-70449 Stuttgart (DE)**(54) **Portable transceiver apparatus with low irradiation of the user, employing an antenna having an asymmetric radiation pattern.**

(57) The present invention relates to a portable transceiver apparatus, in particular a radiomobile telephone set, with low irradiation of the user, comprising a handset and an antenna, having an asymmetric radiation pattern, applied to said handset.

Since such apparatuses, when in use, are placed alongside the user's head, a great amount of electromagnetic waves pass through it, in particular with the continuous increase in the transmission frequency and the consequent decrease in the dimension of the antenna the irradiation of the user's head is and will become a serious problem.

The aim of the invention is to provide a portable transceiver apparatus so as to minimize the irradiation of its user.

By using an antenna having an asymmetric irradiation pattern such as to be extremely limited in the directions of the user's head, a greatly reduced irradiation can be obtained.

**Fig.3****EP 0 588 271 A1**

The present invention relates to a portable transceiver apparatus, in particular a radiomobile telephone set, with low irradiation of the user, including a handset and an antenna applied to said handset.

In Figs. 1 and 2 there are illustrated schematically in a side view two of such sets nowadays extensively used on the market, in particular in Fig. 1 the Motorola 8800X model and in Fig. 2 the 9800X one; however the schematic side view of Fig. 1 is the view of all the portable transceiver apparatuses. Such apparatuses basically comprise a handset AC and an antenna AA applied to the handset. Located inside said handset generally are a loudspeaker AL, a microphone AM, a control panel AK and the circuitry for operating the apparatus.

The antenna AA of a radiomobile telephone set and, more in general, of a portable transceiver apparatus is placed in the upper portion of the handset AC; several models, all of the retractile and fixed whip type are available.

Since such apparatuses, when in use, are placed alongside the user's head, a great amount of electromagnetic waves pass through it; in particular with the continuous increase in the frequency used for transmission (at present a 900 MHz frequency is used but the trend is to reach 60 GHz in the future) the dimensions of the antenna decrease and therefore the distance between the antenna and the user's head will become practically null. Irradiation of the user's head is and will become a serious problem, actually not solved, particularly if the increase in transmission frequency is taken into account.

It is an object of the present invention to provide a portable transceiver apparatus such as to minimize the irradiation of its user.

This object is reached through the portable transceiver apparatus having the characteristics set forth in claim 1; further advantageous aspects of the present invention are set forth in the subclaims.

By using an antenna having a suitable asymmetric radiation pattern, such as to be extremely limited in the direction of the user's head, a considerable reduction in the irradiation can be obtained.

The invention will result better from the following description thereof taken in conjunction with the attached drawings in which:

Figs. 1 and 2 represent schematic side views of two prior art apparatuses, and

Fig. 3 is a possible radiation pattern of the handset-antenna assembly in accordance with the present invention, represented in overlap to an apparatus and to the user's head.

From Figs. 1 and 2 two schematic side views of two prior art portable transceiver apparatuses can be seen; for the purpose of describing the present invention it will suffice to say that such apparatuses

comprise a handset AC and an antenna AA applied to the handset AC.

As already said, the solution, in accordance with the present invention, for limiting the irradiation of the user's head caused by a portable transceiver apparatus consists in using an antenna AA having a suitable asymmetric radiation pattern, such as to be extremely limited in the direction of the user's head.

Naturally the radiation pattern of antenna AA is modified by the handset AC and its content and therefore, for precision's sake, it would be necessary to consider the overall radiation pattern; very often, the contribution from handset AC can be, at least in a first approximation, neglected or made negligible by screening the handset AC itself.

In Fig. 3, e.g., there is shown one of many possible radiation patterns RD of the assembly formed by handset AC and antenna AA in accordance with the present invention, represented in overlap to an apparatus and to the head U of its user.

Such radiation patterns having special shape can be obtained through suitable choice of the type and shape of antenna AA. A first possibility consists in using a screened whip antenna. Another possibility is to use high frequency antenna arrays.

An exhaustive treatment of this topic can be obtained from H. Jasik, Antenna Engineering Handbook, McGraw-Hill, in particular chap. 21 (High-Frequency Arrays) and from section 30.6 (Strip Transmission Lines).

Such arrays basically comprise at least one horizontal-dipole radiator located at a suitable distance from a horizontal conducting plane.

Several dipoles may be placed in parallel to form bays and several bays can be associated to form curtains. Depending on the number and position, the radiation pattern assumes special shapes respectively increasing the vertical and horizontal directivity.

In addition to the radiator(s) at least one reflector can be placed in the back zone to limit the radiation pattern in suitable directions; such reflectors can be constituted by tuned dipoles operating in a passive manner, or by a vertical reflecting screen, composed of densely-spaced horizontal turns.

Other types of antennas usable individually or in array fashion are, e.g., horizontal rhombic antennas, long singlewire antennas, horizontal V antennas both resonant and terminated.

It is clear that in order to implement advantageously such types of antennas for use on portable transceiver apparatuses one must be able to reduce at the maximum extent their overall dimensions. Various-shaped microstrip structure and, in addition, metallizing conducting planes are then used, if needed; the whole arranged on a board, of

course.

An exhaustive treatment on microstrip antennas can be found both in the above-mentioned book and in Collin, Robert "Antennas and Radiowave Propagation" McGraw-Hill, in particular at section 4.14 (Microstrip Antennas).

If the antenna is housed on a board, when the apparatus is not in use, the antenna can be located inside it and, when the apparatus is to be used, it can be drawn out by sliding or by turning over; this in order to reduce the overall dimensions and the handiness of the apparatus when not in use, of course.

The possible conformations of the microstrip structures which form the antenna are very many and everyone skilled in the art will be able to find the one which is best suitable for his needs in terms of operating frequency band, of directivity and of gain.

#### Claims

1. Portable transceiver apparatus, in particular radiomobile telephone set, with low irradiation of the user, including a handset and an antenna applied to said handset, characterized in that said antenna has an asymmetric radiation pattern such as to be extremely limited in the directions of the user's head. 25
2. Apparatus according to claim 1, characterized in that said antenna comprises a screened whip antenna. 30
3. Apparatus according to claim 1, characterized in that said antenna comprises at least one horizontal dipole radiator disposed at a suitable distance from a horizontal conducting plane. 35
4. Apparatus according to claim 3, characterized in that said antenna further comprises at least one reflector placed behind said radiator. 40
5. Apparatus according to claim 1, characterized in that said antenna is a rhombic antenna. 45
6. Apparatus according to claim 1, characterized in that said antenna is a long single-wire antenna. 50
7. Apparatus according to claim 1, characterized in that said antenna is a resonant or terminated V antenna.
8. Apparatus according to claim 1, characterized in that said antenna comprises variously conformed microstrip structures. 55
9. Apparatus according to claim 8, characterized in that said antenna further comprises metallic conducting planes.
10. Apparatus according to claim 8, characterized in that said antenna is housed on a board that is located inside the apparatus when the latter is not used and can be drawn out by sliding or by turning over when the apparatus is to be used.

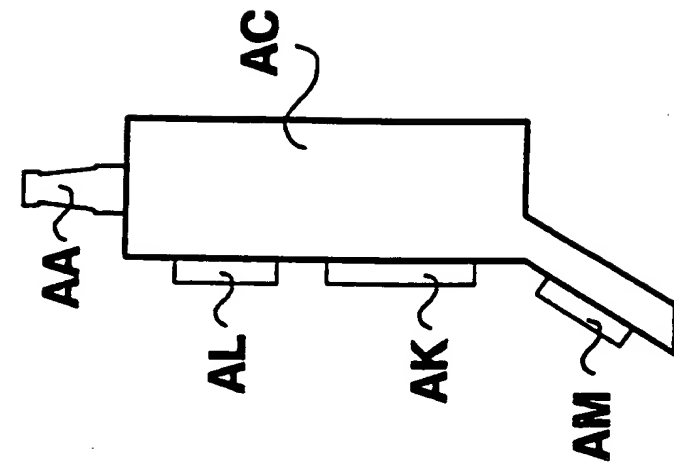


Fig.1

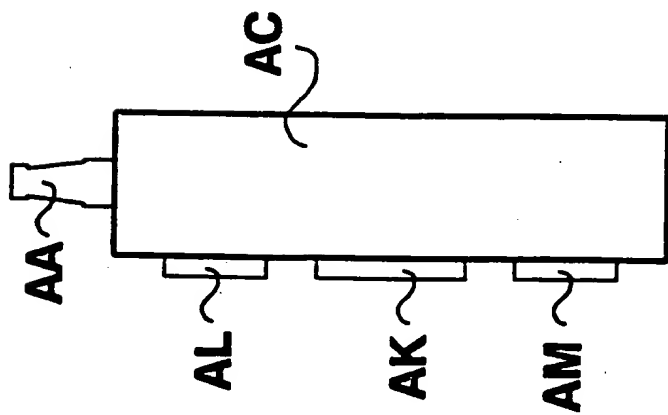


Fig.2

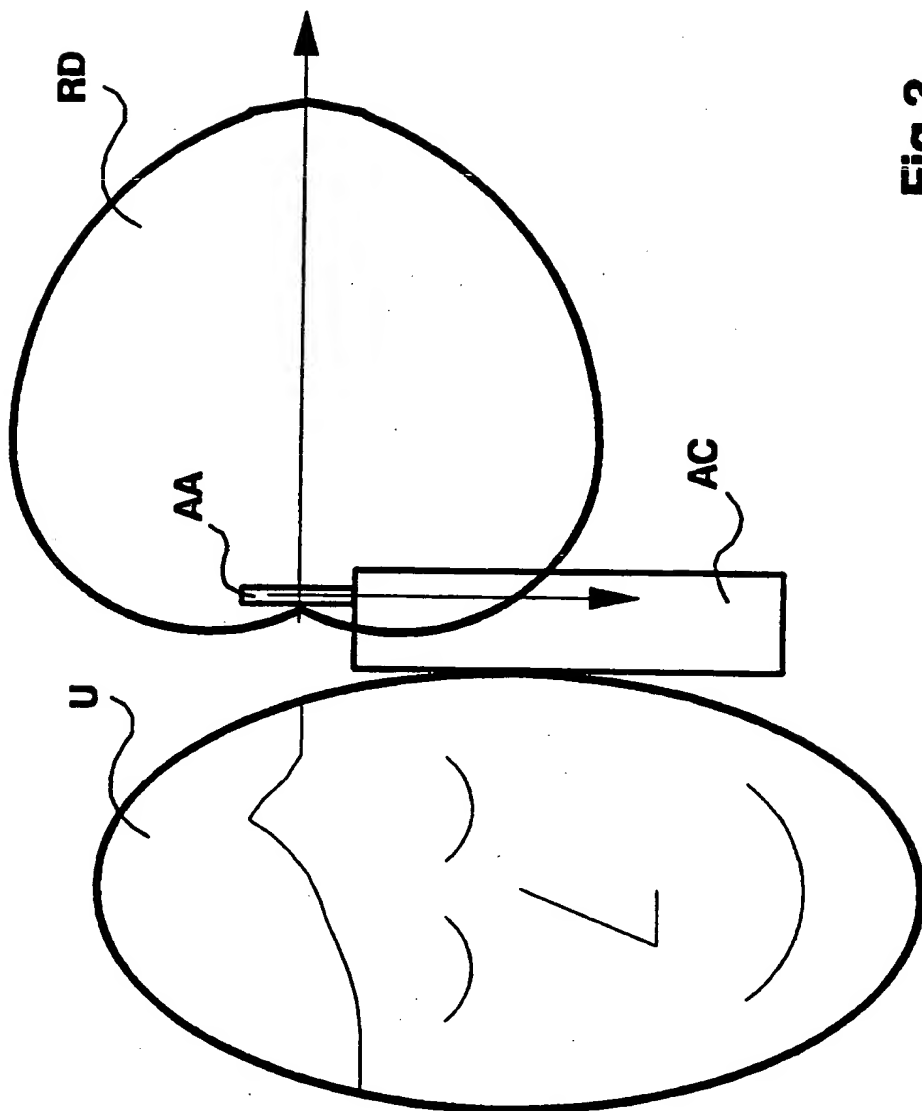


Fig.3



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## EUROPEAN SEARCH REPORT

Application Number  
EP 93 11 4643

| DOCUMENTS CONSIDERED TO BE RELEVANT   |   |                                  |   |
|---|---|----------------------------------|---|
| Category  | Citation of document with indication, where appropriate, of relevant passages     | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (Int. CL.5) |
| X   | EP-A-0 214 806 (NEC)<br>* page 4, line 12 - page 9, line 19;<br>figures 1,3,4 *   | 1-9                              | H04B1/38<br>H01Q1/24                          |
| A   | ---   | 10                               |   |
| A,D   | JASIK 'Antenna Engineering Handbook'<br>1975, MCGRAW-HILL, NEW YORK<br>Chapter 21 |                                  |   |
| A   | ---   | 8,9                              |   |
|   | EP-A-0 339 629 (MOTOROLA)<br>* abstract; figures 4,5,7 *                          |                                  |   |
|   | -----   |                                  |   |
| The present search report has been drawn up for all claims  |   |                                  | TECHNICAL FIELDS SEARCHED (Int. CL.5)         |
|   |   |                                  | H04B<br>H01Q                                  |
| Place of search   |   | Date of completion of the search | Examiner                                      |
| THE HAGUE   |   | 15 December 1993                 | Andersen, J                                   |
| CATEGORY OF CITED DOCUMENTS   |   |                                  |   |
| T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>I : document cited for other reasons<br>-----<br>& : member of the same patent family, corresponding document |   |                                  |   |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document   |   |                                  |   |